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APPLICATION NUMBER: ***60/551,199***
FILING DATE: ***March 08, 2004***
RELATED PCT APPLICATION NUMBER: ***PCT/US05/07363***

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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53(c)

Express Mail Label No.	**EL 974045281 US**

INVENTOR(S)

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Steven E.	BEARD	36 Barnes Road, Berlin, MA 01503

Additional inventors are being named on the separately numbered sheets attached hereto.

22264 U.S. PTO 60/551199 030804

TITLE OF THE INVENTION (500 characters max)

LINEAR INTERNAL COMBUSTION ENGINE

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ENCLOSED APPLICATION PARTS (check all that apply)

X	Specification	Number of Pages	19		CD(s), Number	
	Drawing(s)	Number of Sheets			Other (specify)	
	Application Data Sheet. See 37 CFR 1.76					

METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT (check one)

X	Applicant claims small entity status. See 37 CFR 1.27		FILING FEE AMOUNT ($)
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This invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

X	No
	Yes, the name of the U.S. Government agency and the Government contract number are :

Respectfully submitted, ATTORNEY DOCKET NO.: 006-456-002

Signature: Gerry A Blodgett Date 3/8/04

Typed Name: [X] GERRY A. BLODGETT, Reg. No. 26,090 [ ] THOMAS C. BLODGETT, Reg. No. 30,933
[ ] WILFRED F. DESROSIERS, Reg. No. 25,531

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Gerry A Blodgett
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January 26, 2004

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Ref LINEAR INTERNAL COMBUSTION ENGINE
Client 857 Matter 006-456-000

Gerry

Enclosed is material for a provisional patent application. There are two parts. The valve actuator which is an outgrowth of our work on the Linear and has application to today's engines and the armature which is a part of the Linear.

As with the last provisional application, Steve Beard and I are co inventors of this.

Also, we will be showing the engine and demonstrating the valve actuator at the SAE World Congress in Detroit March 8-11.

Best regards,

G. Brandt Taylor

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cover + 6 pages

Express Mail No. EL 974045281 US

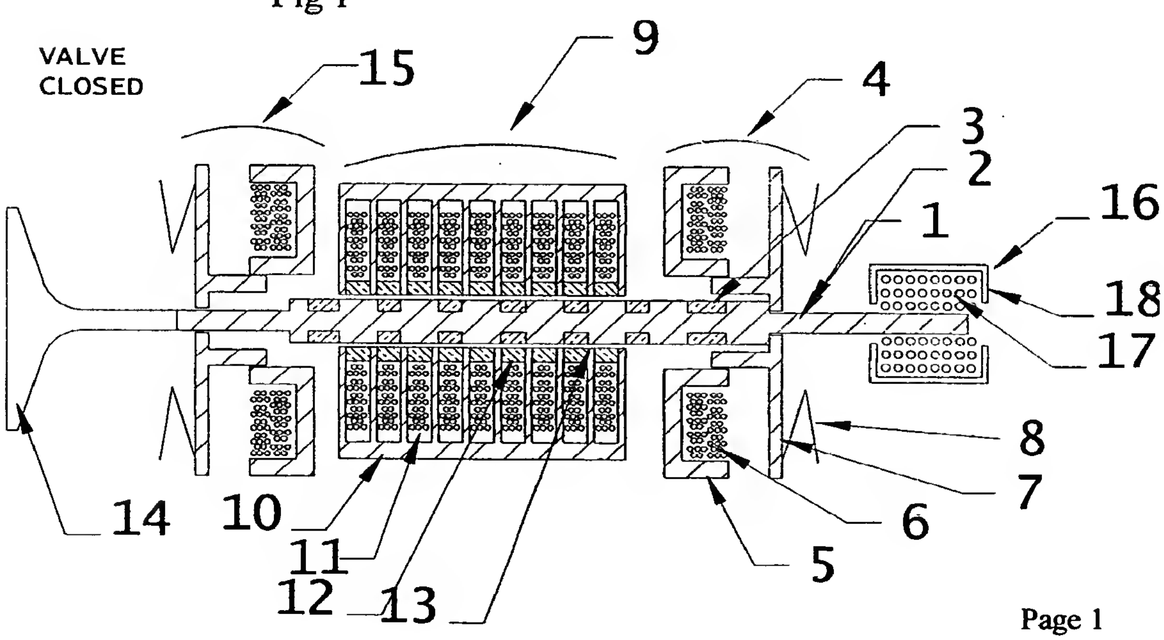
Electronic valve actuator Revision 1/26/04

Fig 1 shows a cross section of an electronic valve actuator described here. Armature 1 is composed of magnetic material (for example steel) in area 2 that is segmented by non-magnetic material (for example 304 stainless steel) in multiple areas 3. Associated with each end of the armature are solenoids 4 and 15. The solenoids are made of winding 6 enclosed on its inside diameter, its outside diameter and one face by case 5. Case 5 is made of magnetic material (iron, etc.). Plunger 7 is attached to damping spring 8. When electric current is passed through coil 6 plunger 7 is moved toward case 5 causing armature 1 to move, in turn moving valve 14.

Transducer section 9 is composed of multiple windings 11 that are each divided from adjacent windings by segments of case 10. Case 10 is made of magnetic material (iron, etc.) The inside diameters of each coil 11 are separated from the armature by non-magnetic sections 12. The inside diameter of each section 12 and case 10 forms a smooth surface on which the armature can slide back and forth.

Position of the armature relative to the actuator body is determined by sensor 16 which is comprised of coil 17 and shield 18. This in turn measures the position of the valve 14.

Fig 1



Page 1

Fig 2 valve closed

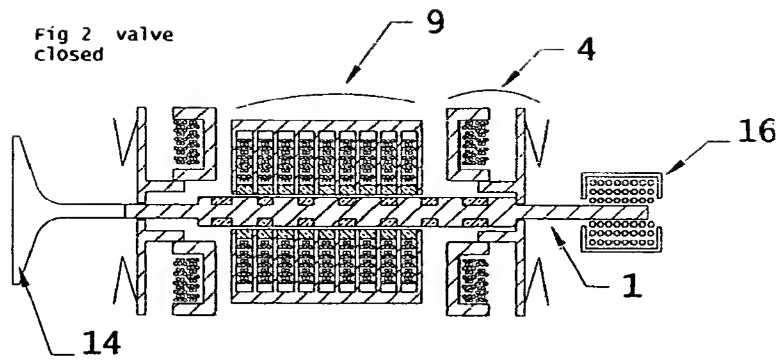


Fig 3 valve opening

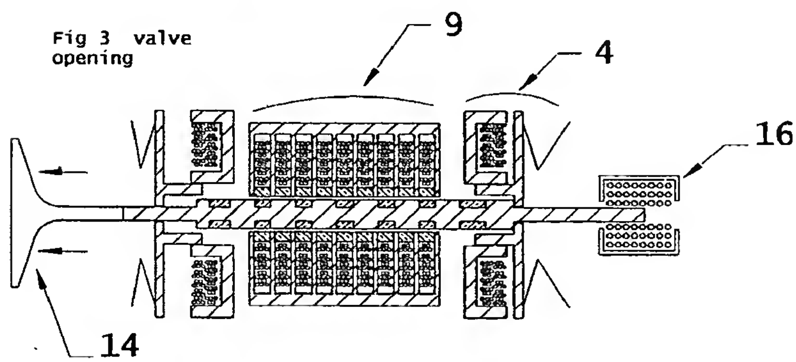


Fig 4 valve fully open

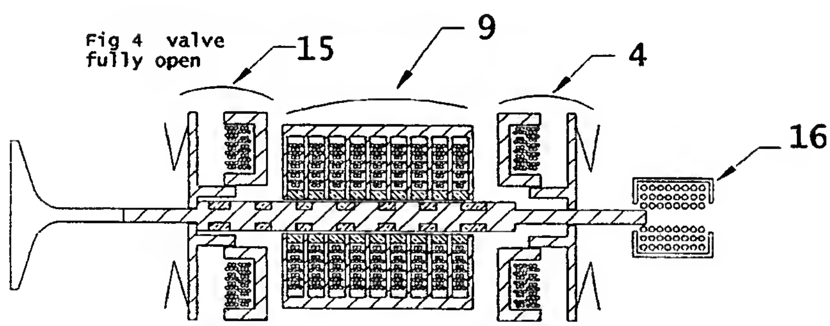
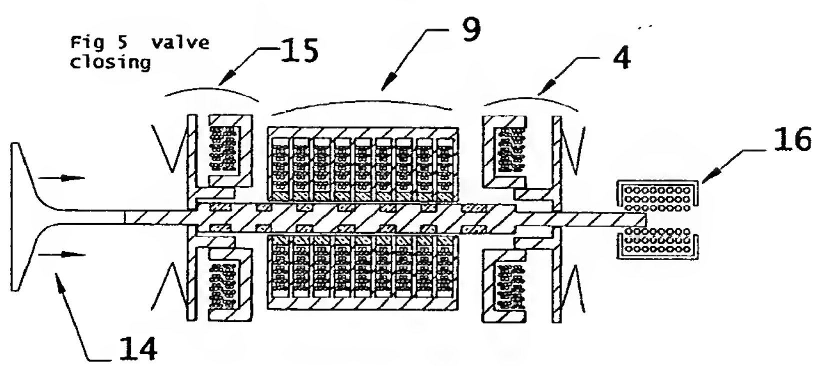


Fig 5 valve closing



Page 2

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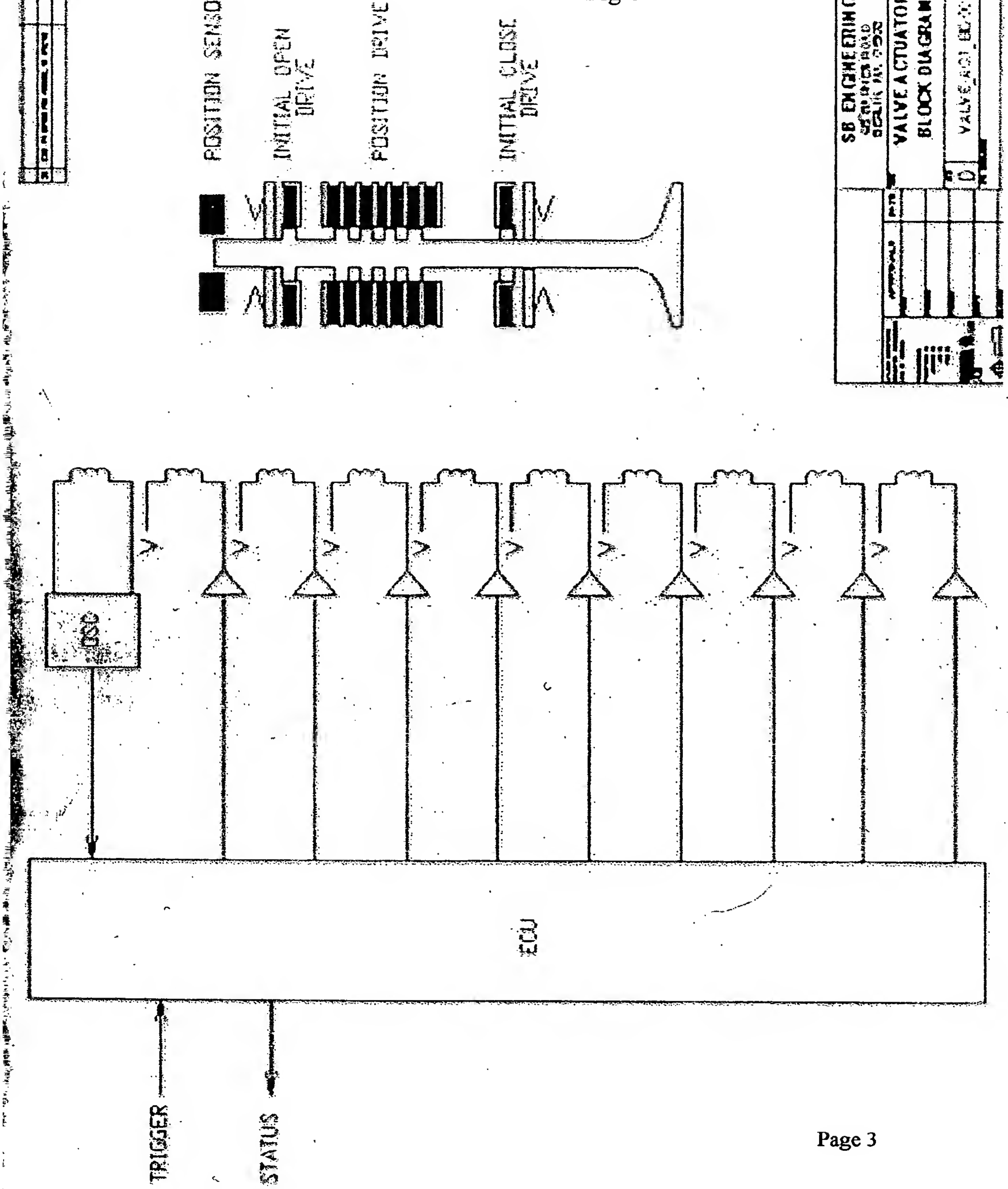
Fig 6


POSITION SENSOR
INITIAL OPEN DRIVE
POSITION DRIVE
INITIAL CLOSE DRIVE
SB ENGINEERING
VALVE ACTUATOR
BLOCK DIAGRAM
OSC
ECU
TRIGGER
STATUS

Page 3

Fig 2,3,4,and 5 depict the valve actuator in operation. Fig 6 is an electronic block diagram of the valve actuator and its interface with its associated control device.

Description of operation

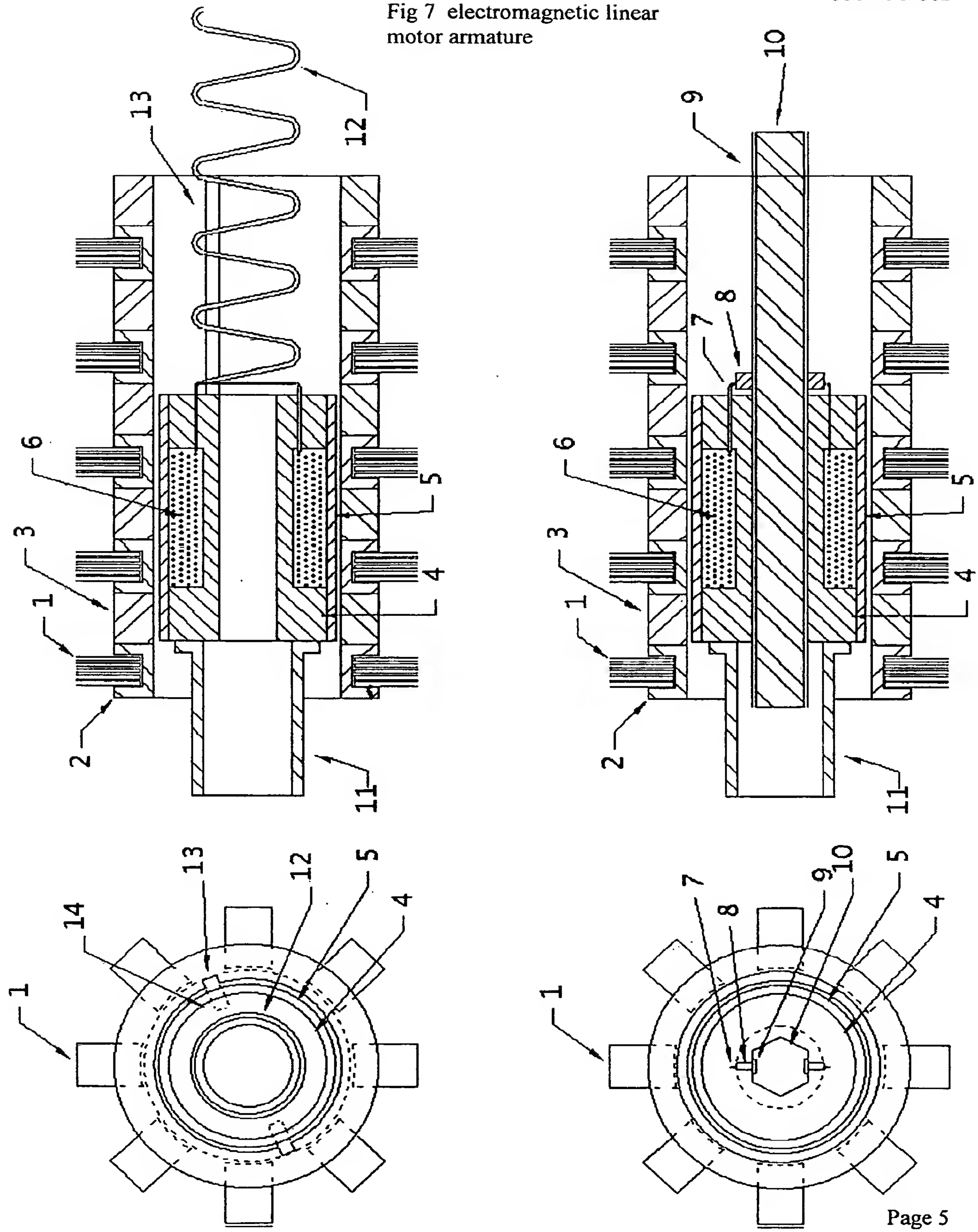
In Fig 2 the valve is closed. The end of the armature away from the valve is against plunger 7 of solenoid 4.

In Fig 2 the valve is opening. Solenoid 4 is actuated moving plunger 7. The various coils in transducer section 9 are actuated for positioning of the valve to its desired opening and velocity.

In Fig 4 the valve is opened.

In Fig 5 the valve is closing. Solenoid 15 is actuated moving its plunger that in turn moves the valve 14. The various coils in transducer 9 are actuated variably to position the valve and regulate the valves velocity. Throughout the movement of the armature and valve the position of the end of the armature is sensed by coil 16.

Fig 7 electromagnetic linear motor armature



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Electromagnetic armature for linear internal combustion engine

Fig 7 is a representation of an electromagnet armature for the linear internal combustion engine. In the drawing the armature is shown within a section of the stator assembly. The stator assembly is comprised of laminated sections 1 that fit into rings 2 that are made of magnetic material (iron, etc.). Magnetic rings 2 are separated from each other by nonmagnetic rings 3. Rings 3 are made of nonmagnetic material as type 304 stainless steel, etc. The armature is comprised of core 4 and coil 6 held inside bearing 5. The armature gets electrical power alternately from wire 12 or brush 8 that contacts electrical contact strip 9. The armature is prevented from rotating on the axis of the stator alternately by shaft 10 or key way 13.

The reason for using an electromagnetic armature in the linear internal combustion engine is that it allows the field strength in the armature to be varied. With a permanent magnet armature this is not possible. By varying the field strength in the armature the electric output of the device is high when there is high pressure in the combustion cylinder and as the pressure in the cylinder decreases with expansion the electric load on the engine is lowered so that more power is extracted from each combustion event. Also the combustion chamber may be allowed to expand to a larger extent exposing more cylinder wall which causes more heat transfer out of the combustion gas. This heat transfer and large combustion chamber volume cause the pressure in the combustion chamber to go to a level below atmospheric pressure causing a force to arise on the piston moving it toward the cylinder head. Depending on the length of the time between combustion events the low pressure in the combustion chamber can be used to make electric output or simply return the piston to the top of the cylinder without power input. In ether case overall operating efficiency of the engine is increased.

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March 4, 2004

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Ref LINEAR INTERNAL COMBUSTION ENGINE
Client 857 Matter 006-456-000

Gerry

Enclosed is material for a provisional patent application. There are two parts. A valve actuator which is an alternative design from the one which was disclosed to you in my letter January 26, 2004. Also, there is description on an electronic circuit for controlling electronic valve actuators.

As with the last provisional application, Steve Beard and I are co inventors of this.

Best regards,

G. Brandt Taylor

Electronic Valve Actuator Model 402. Date 4/4/04

Fig 1. shows a cross section of an electronic valve actuator described here. Armature 1 is composed of magnetic material (for example iron) and is fixed to valve 4. Valve 4 is made of nonmagnetic material (for example 303 stainless steel). Associated with armature 1 are electromagnetic coils 2 and 3. When coil 3 is actuated it causes the armature valve assembly to move to the right on the page and closes the valve. When coil 2 is actuated it causes the armature valve assembly to move to the left on the page and opens the valve. Fixed to one end of the valve is cylinder 5 which is made of magnetic material. Sensor coil 6 is held in fixed relationship to coils 2 and 3. Movement of cylinder 5 inside coil 6 causes a change in the reluctance of the magnetic field produced by coil 6 and this change can be measured. From this change in measurement position of the cylinder relative to the coil and hence of the valve relative to the actuator may be determined.

In Fig 2 the valve is in its open position. By varying the current to the coils 1 and 2 the position and velocity of the valve may be changed. Also, a force may be created to hold the valve in any position from open to closed. Output from coil 6 allows a computer to control the movement of the valve.

Fig. 1

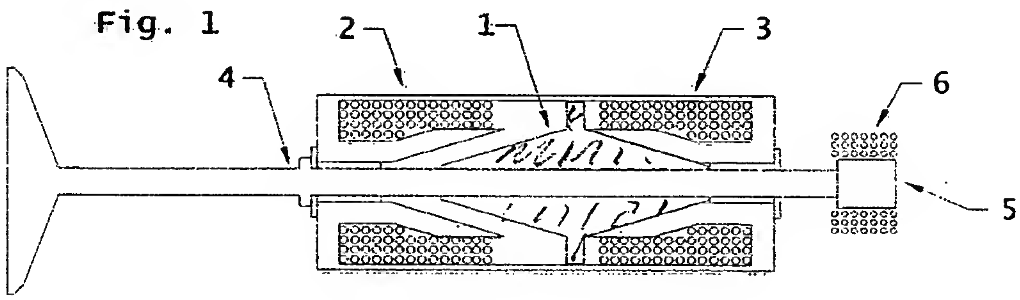
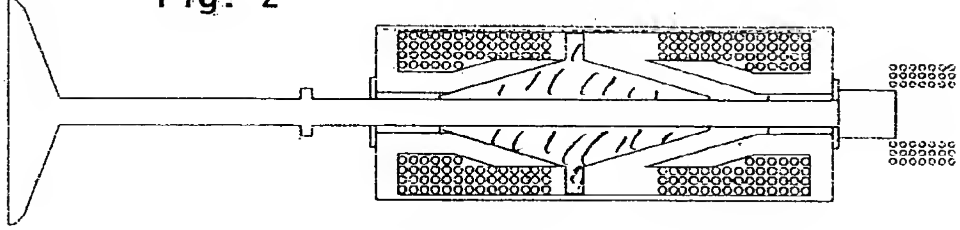


Fig. 2



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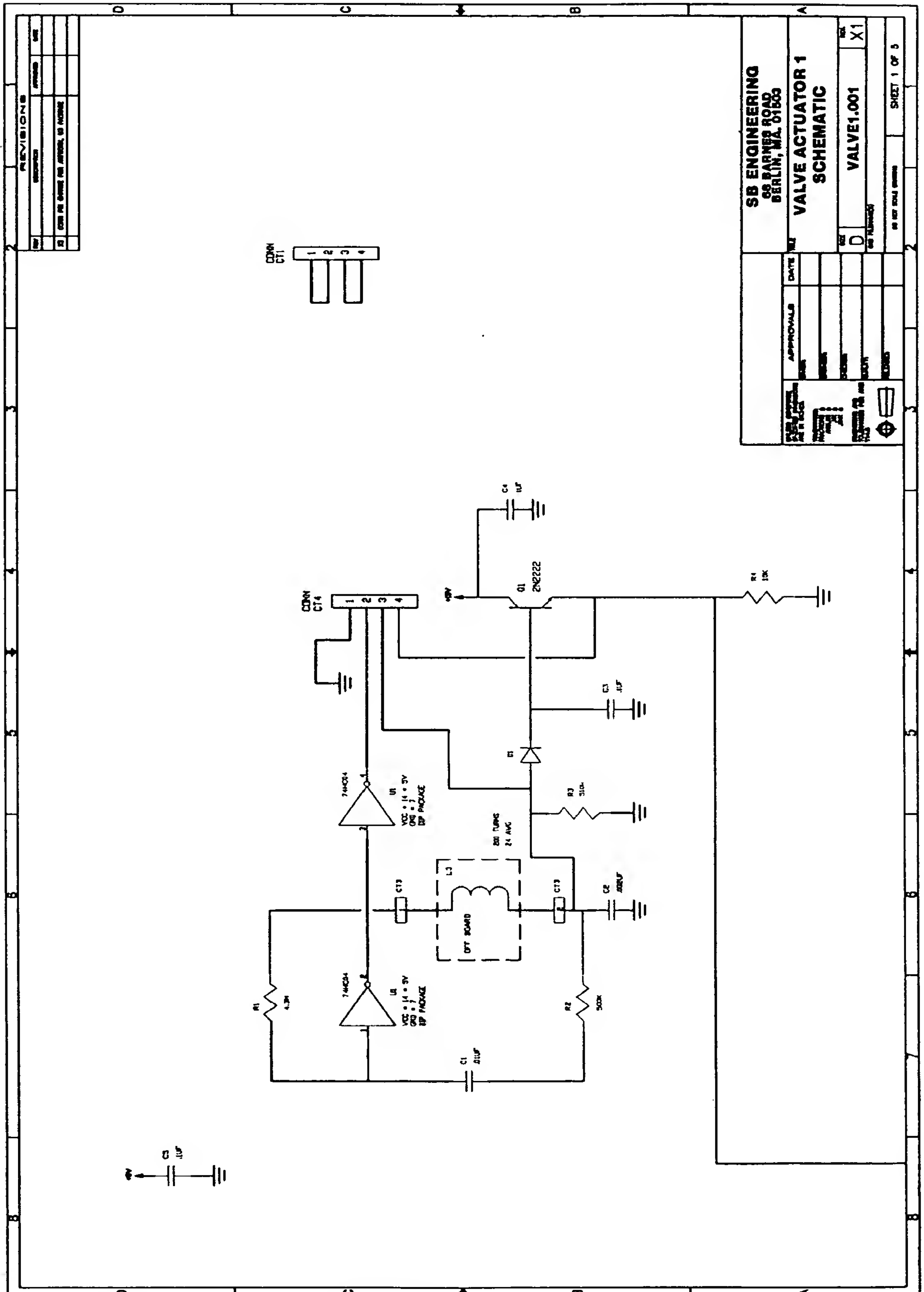
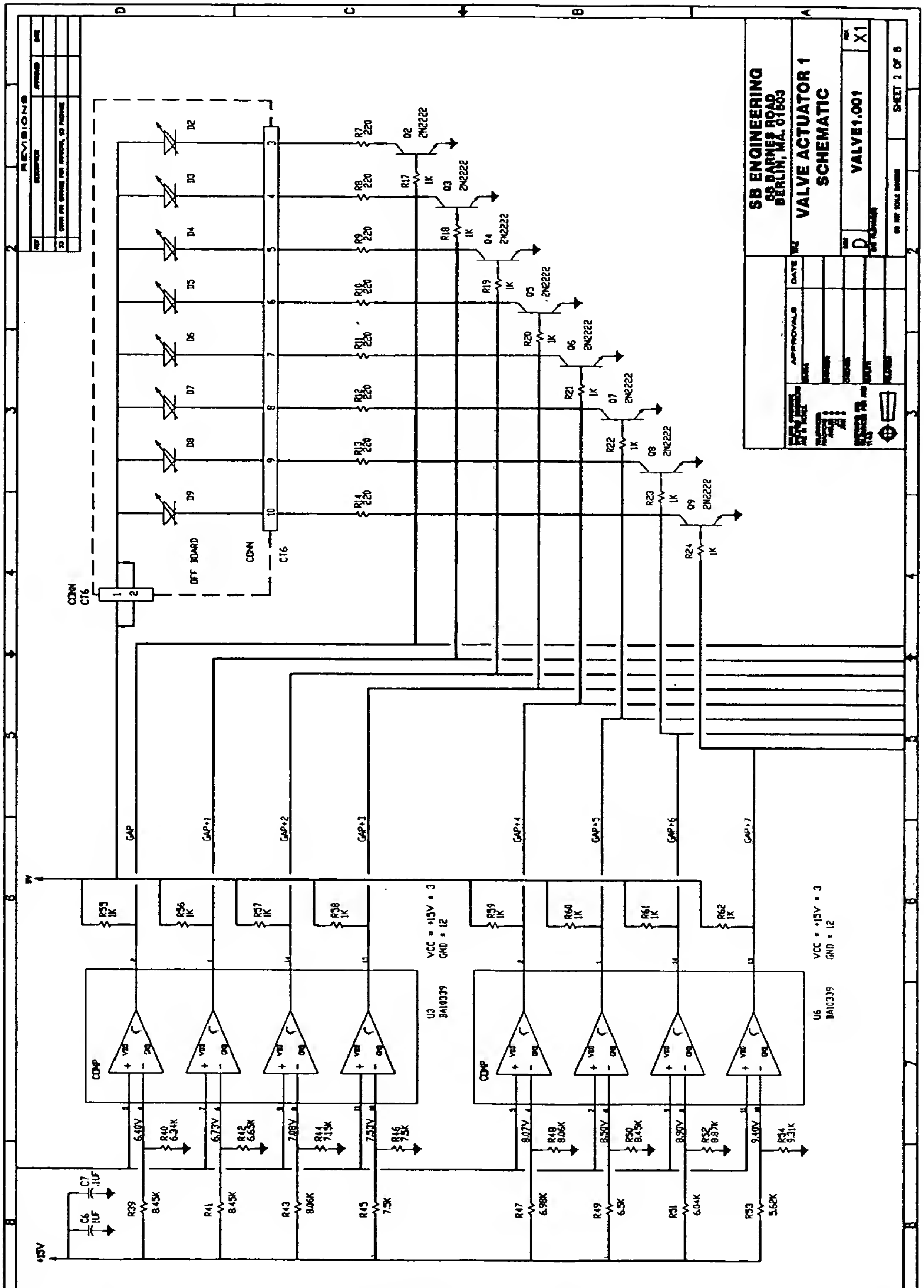

REVISIONS
SB ENGINEERING
68 BARNES ROAD
BERLIN, MA. 01503
VALVE ACTUATOR 1
SCHEMATIC
VALVE1.001
SHEET 1 OF 5
CONN
CT1
CONN
CT4
Q1
2N2222
74HC04
74HC04
OFF BOARD
200 TURNS
24 AWG



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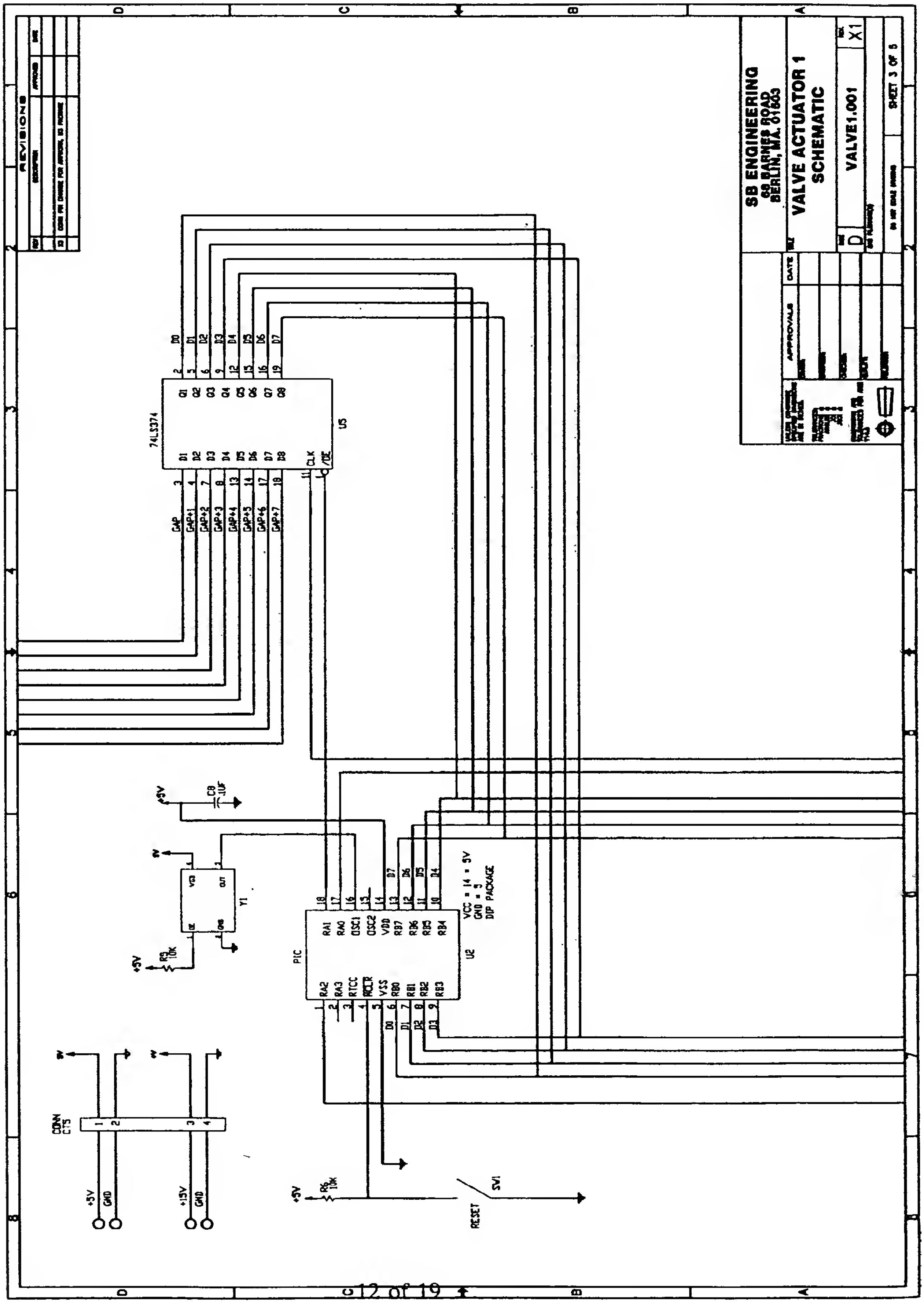
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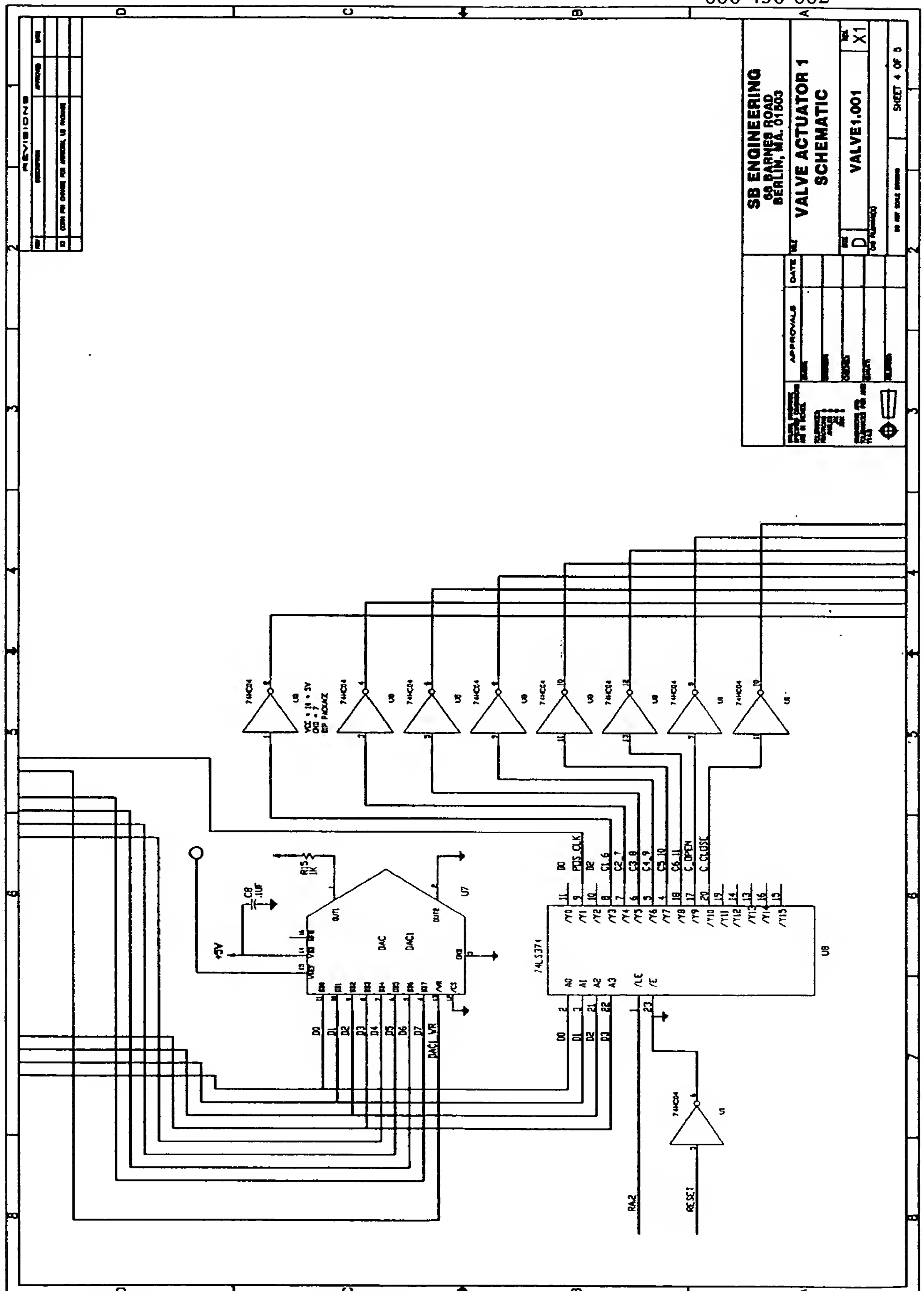
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SHEET 4 OF 5
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74LS374
DAC
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RA2
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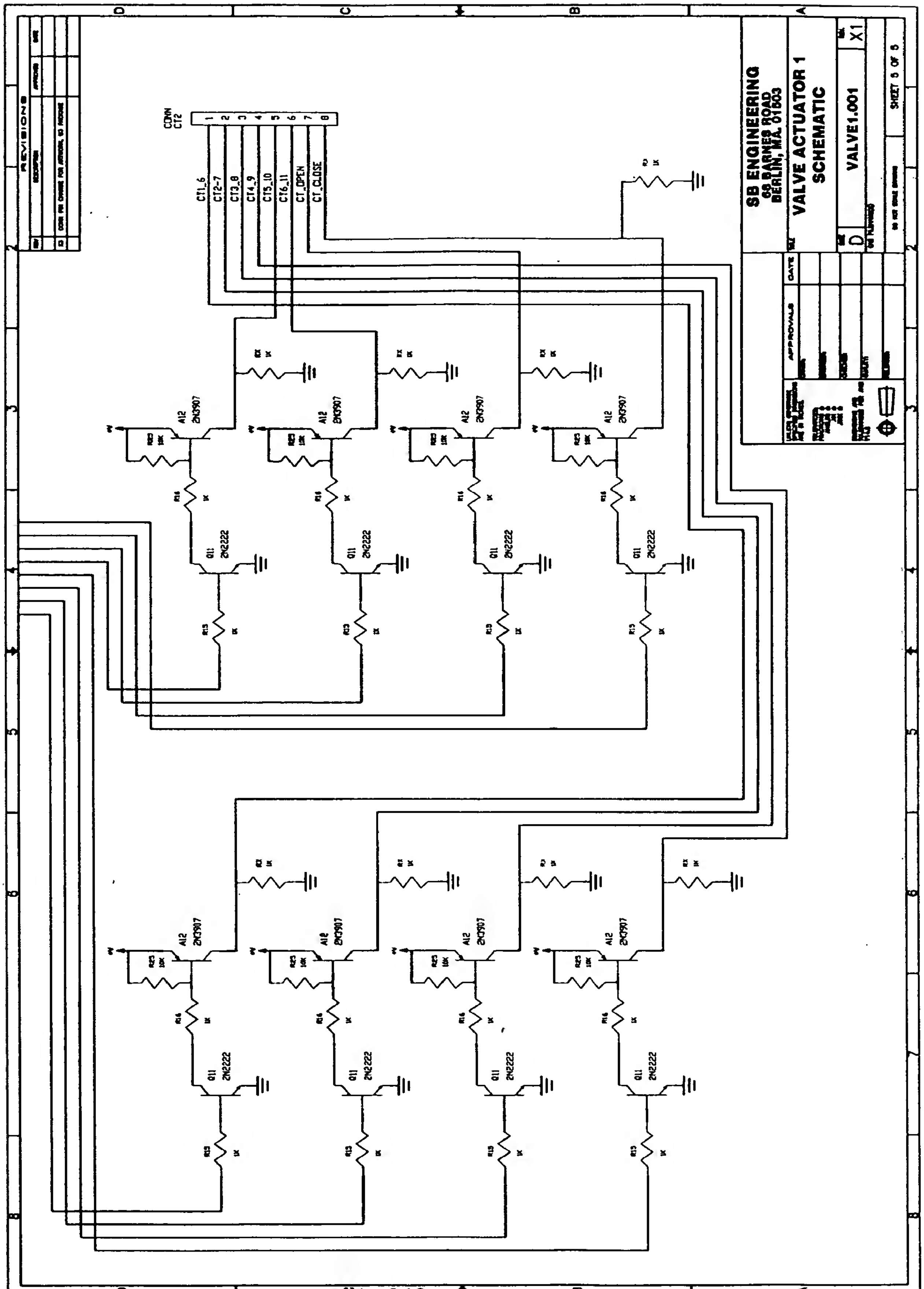
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SHEET 5 OF 5
REVISIONS
CONN
CT2
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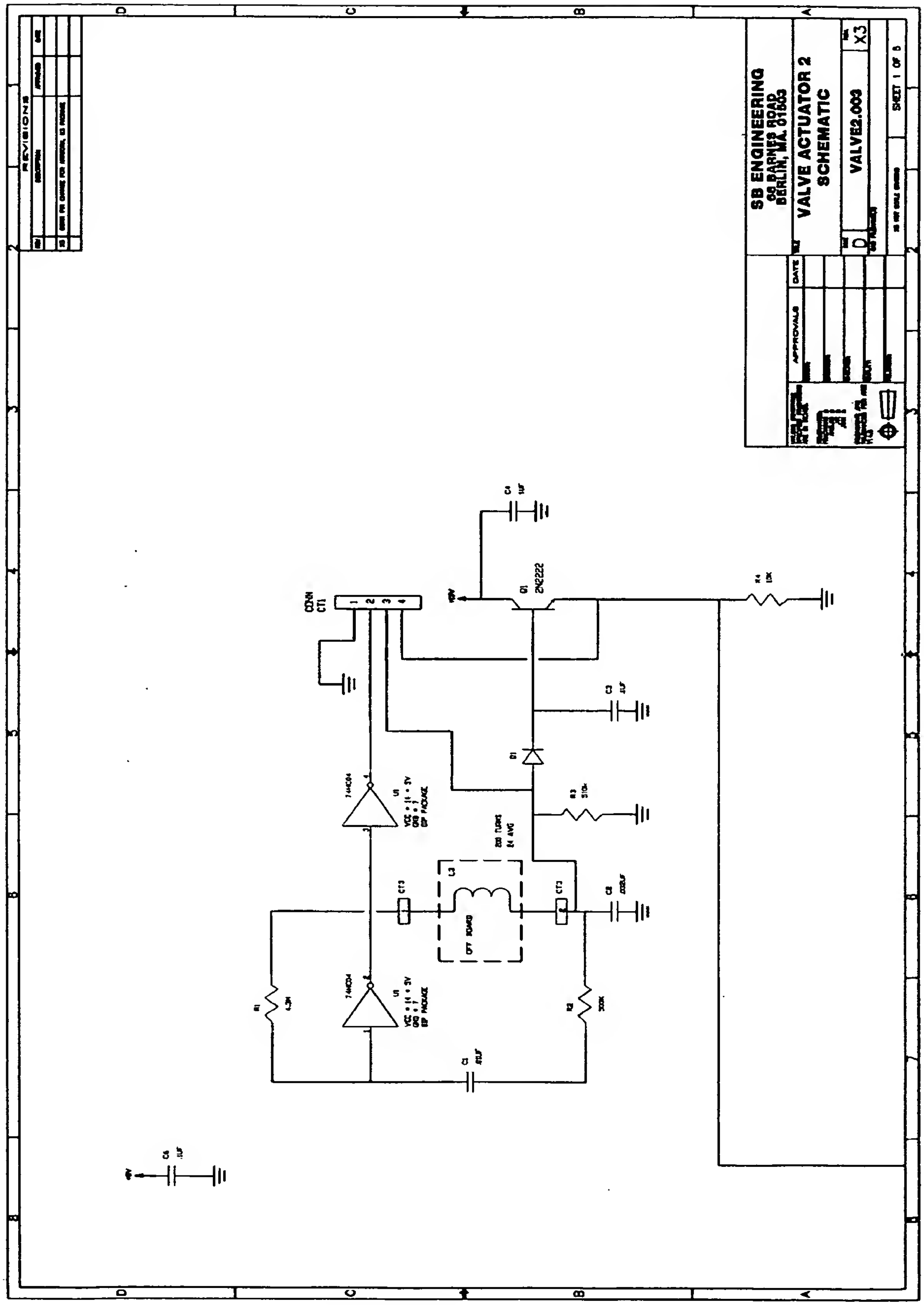
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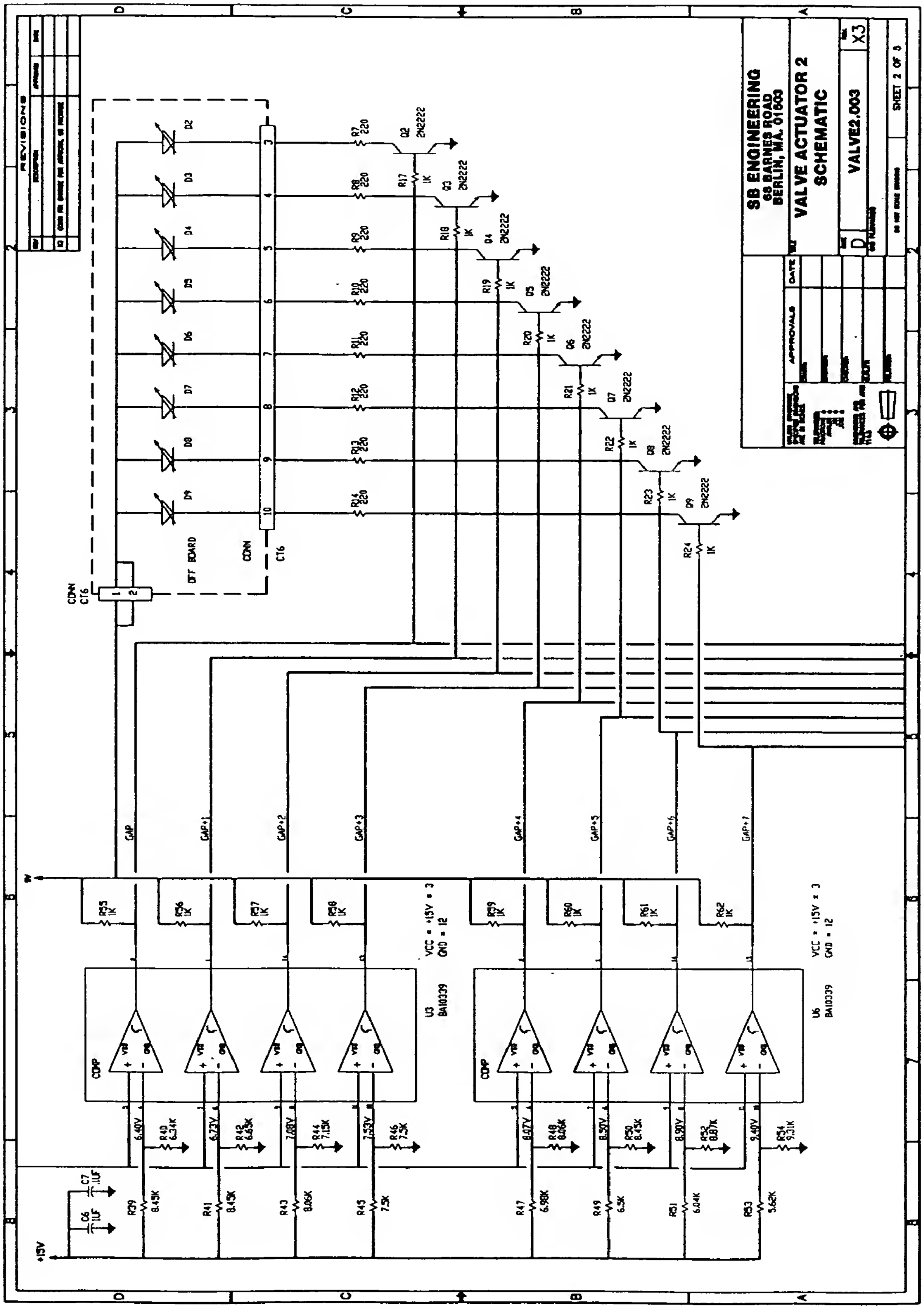
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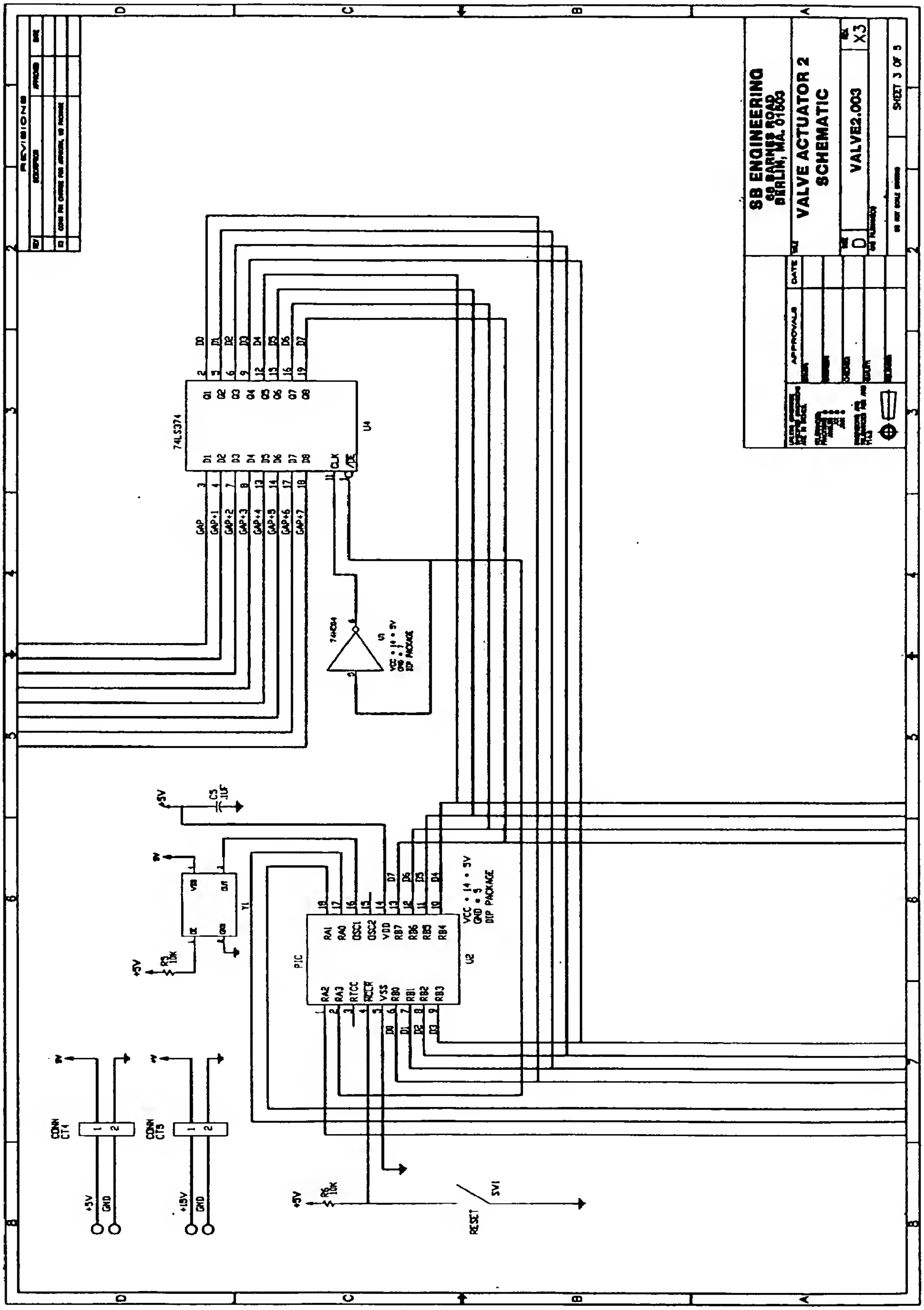

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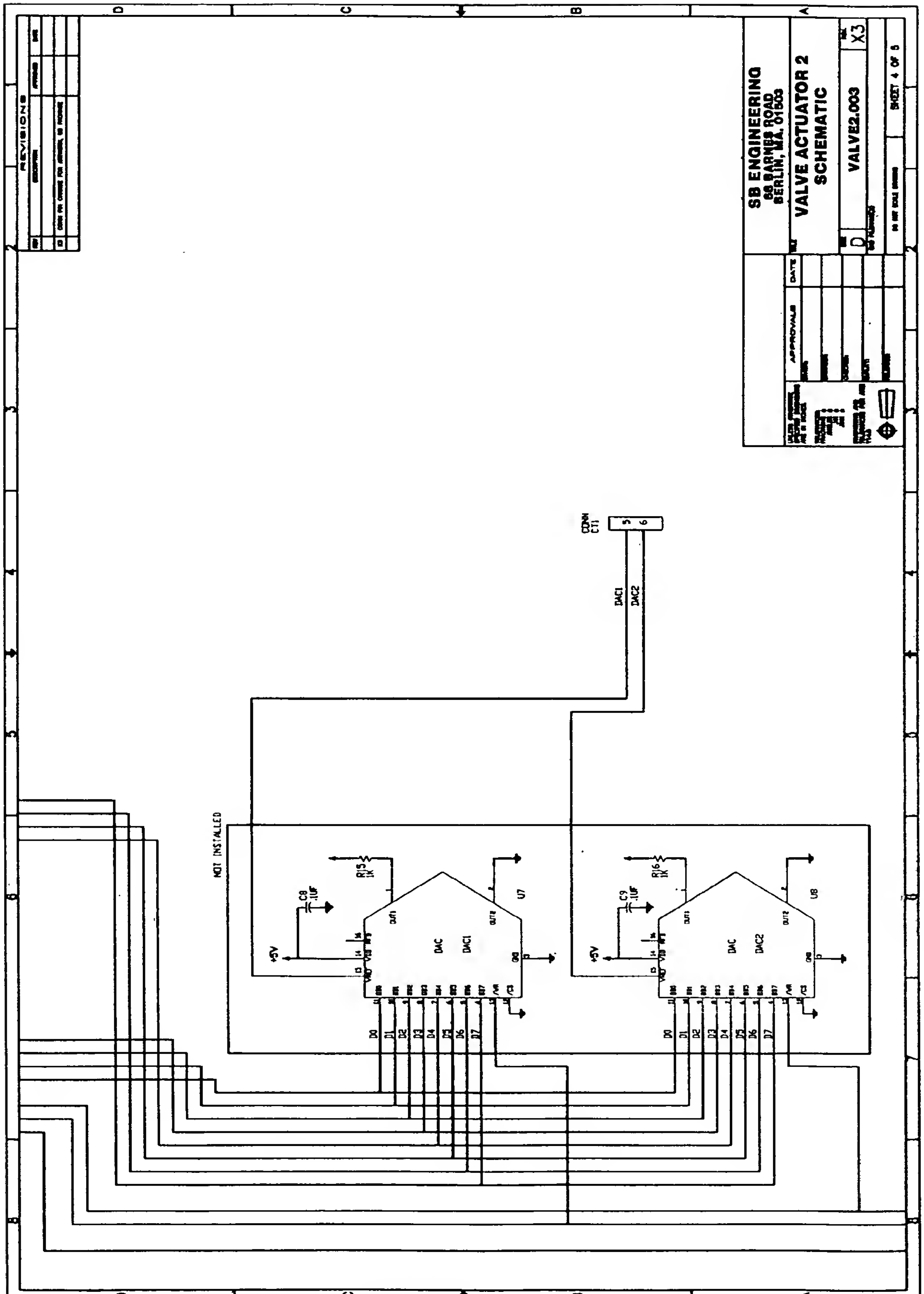

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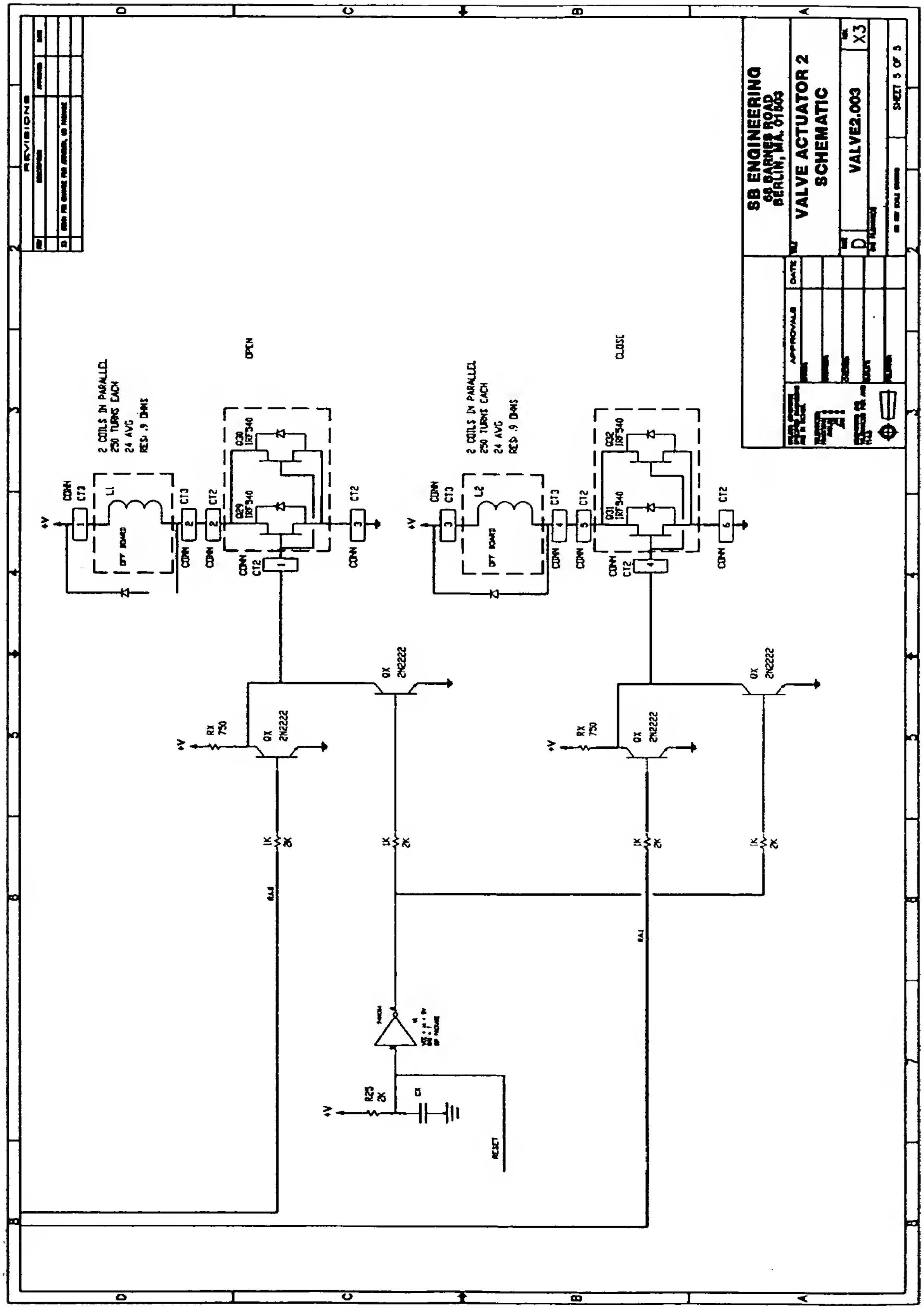

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